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ADMINISTRATIVE REPORT H-90-01

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Southwest Fisheries Center Administrative Report H-90-1

STATUS OF HAWAII'S BOTTOM FISH FISHERY IN 1988

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INTRODUCTION

The Bottomfish and Seamount Groundfish Fishery Management Plan (FMP) of the Western Pacific Regional Fishery Management Council (Council) calls for an annual report on various aspects of the regulated fisheries. The Council's Plan Monitoring Team has taken the approach of preparing a series of independent reports (modules) from which to compose the annual report. This paper is the module providing estimates of the total volume of Hawaii's commercial landings of bottom fish in 1988, a long-term perspective on landings, and information on the operational and economic performance of the fleets. Reliable estimates of the recreational and subsistence components of the fishery are not available.

Information on the bottom fish fishery's biological status (including species identification) is in Somerton et al. (1989), and information on the bottom fish fisheries of American Samoa, Guam, and the Commonwealth of the Northern Mariana Islands is in Hamm and Quach (1989). Because of differences in data conventions and continued revision of the data sets, small differences may exist between the numerical figures given in their reports and between this and previous reports.

RECENT DEVELOPMENTS

Activity in the bottom fish fishery in the Northwestern Hawaiian Islands (NWHI) declined substantially in 1988 while total landings by the fishery in the main Hawaiian Islands (MHI) grew. Most of the MHI increase came from an apparently cyclical increase in the landings of uku (a gray snapper). The fresh fish market for bottom fish remained strong, with average bottom fish prices at $2.71 per pound. Imports of fresh and fresh-frozen bottom fish into Hawaii declined slightly to 13% of the total market. The dynamics of the fleet--entry and exit patterns of fishing vessels--will change substantially in the forthcoming years, as a result of the limited entry program implemented in the NWHI bottom fish fishery in January 1989. Although 28 vessels held permits to fish in the NWHI in 1988 before the implementation of the limited entry program, only 13 vessels actually fished. Only four vessels were fishing for bottom fish full time by the end of 1988, compared with eight full-time vessels in 1987. Most of the vessels that left the bottom fish fishery entered the apparently more lucrative tuna longline fishery, which expanded dramatically in 1988. The decision of many of the NWHI bottom fish fishermen to leave the fishery was due to a number of factors: the growing interest in the tuna longline fishery, the increased bottom fish landings from the MHI depressing expected prices, the low levels of NWHI catch rates, increases in distances traveled to reasonable fishing grounds, and the difficulty in finding and catching opakapaka, the prized species.

Most of the NWHI skippers reported that bottom fish catch rates on individual banks have declined, forcing them to search more banks to make a load. There has been renewed interest in a "mixed bag" in landings (i.e., wider diversity in species composition of the landings). The increased price of hapuupuu (a sea bass) has prompted skippers to target that species in addition to opakapaka. The larger size and longer shelf life of hapuupuu makes possible longer trips in which the general strategy is to fish for hapuupuu early in the trip and target the more fragile opakapaka toward the end of the trip.

FLEET OPERATIONS IN THE NWHI

The operations of the bottom fish fleet in the NWHI are monitored in Honolulu by technicians of the Fishery Management Research Program of the Southwest Fisheries Center Honolulu Laboratory, National Marine Fisheries Service (NMFS), NOAA. The resulting estimates may underestimate fleet activity because the vessels off-loading on the Islands of Kauai, Maui, and Hawaii are not monitored.

Ninety-three bottom fish fishing trips were made to the NWHI in 1988 by 13 different vessels (Table 1; Fig. 1), representing a 50% decline in active vessels and a 30-45% decline in the number of trips since 1987. During 1988, 7-10 vessels fished the NWHI regularly, but by year's end, only 6 vessels appeared to be active participants, and 2 of them had just entered the fishery.

Table 1.--Activity of the bottom fish fleet in the Northwestern Hawaiian Islands, 1984-88 (BMUS = bottom fish management unit species). Data are based on a consistent sample of the fleet in each year.

	1984	1985	1986	1987	1988
Vessels (No.)	19	23	24	28	13
Trips (No.)	135	160	163	134	93
Trips/vessel (No.)	7	7	8	8	7
Days at sea			2445	2211	1418
Days fished			978	938	651
Days/trip			15	16	15
Days fished/trip			6	7	7
BMUS/trip (pounds)	4,318	4,659	4,803	6,145	5,502
Total catch/trip (pounds)			5,805	7,303	6,842
BMUS/fishing day (pounds)			800	877	786
Total catch/fishing day (pounds)			967	1,043	977
Revenue/trip (US$)			13,125	17,462	16,400
Revenue/vessel (US$)			87,500	83,571	117,324

The average trip in 1988 made by NWHI bottom fish vessels lasted 15 days: 7 days fishing and 8 days traveling. Trip length in terms of travel time was actually greater in 1987 (7 days fishing versus 9 days traveling). During the year, individual vessels made as few as 1 trip to the NWHI and as many as 14. The average number of trips per vessel in 1988 was seven, an increase from five in 1987. This increase reflects the perseverance of a core group of fishermen, despite heavy competition and declining catch rates for prized species.

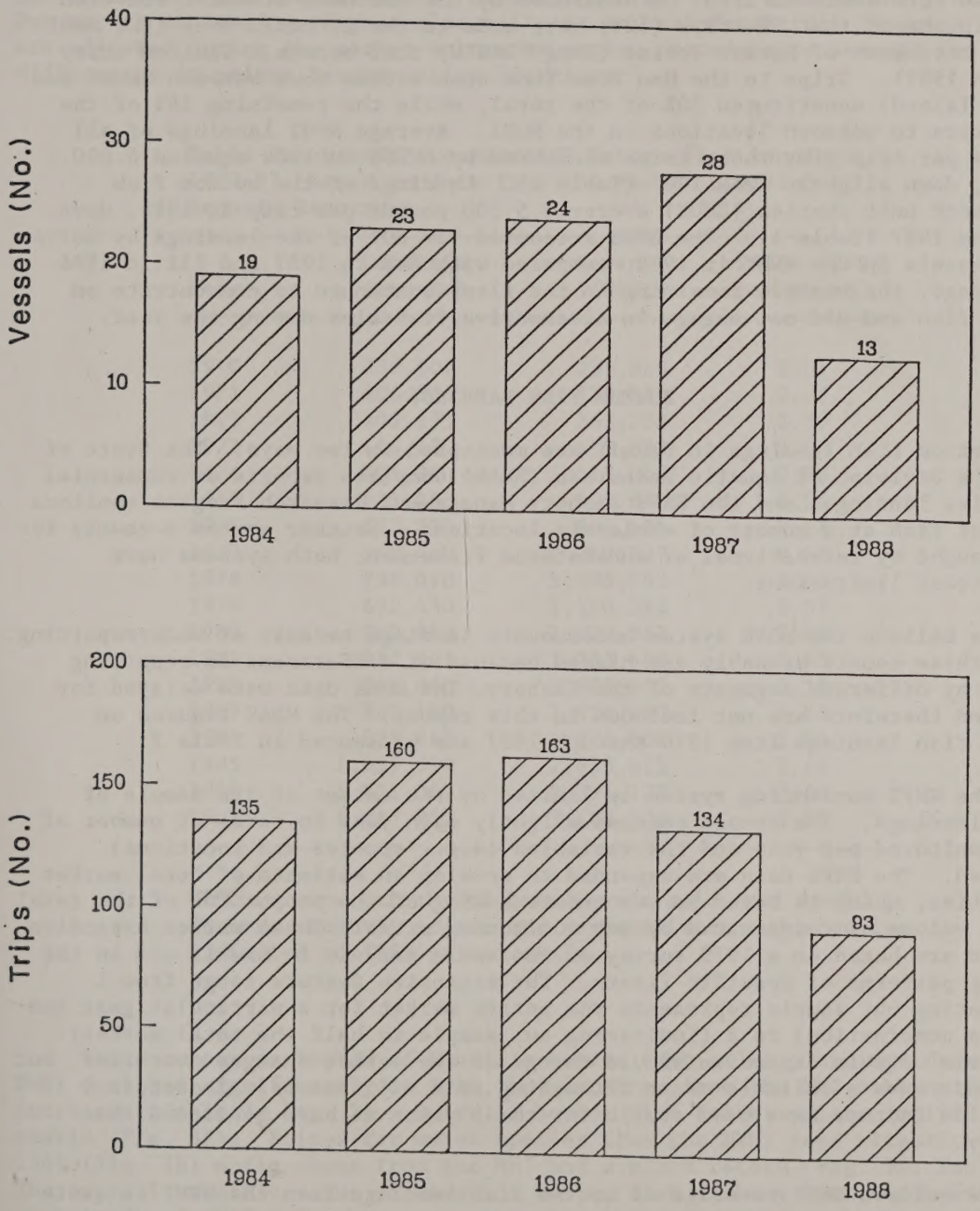


Figure 1.--Number of vessels participating in, and trips taken by, the bottom fish fleet in the Northwestern Hawaiian Islands, 1984-88. Data are from the monitoring program of the National Marine Fisheries Service.

The NWHI bottom fishing vessels fished the entire range of the NWHI, from Nihoa to Kure Atoll in 1988. A breakdown by the farthest distance traveled per trip showed that 58 trips (52%) were made to the Ho'omalu Zone (the NWHI region northwest of Necker Island (long. 165°W) that became a limited entry zone in 1989). Trips to the Mau Zone (the open access zone between Kauai and Necker Island) constituted 20% of the total, while the remaining 28% of the trips were to unknown locations in the NWHI. Average NWHI landings of all species per trip (for those trips monitored by NMFS) in 1988 equaled 6,800 pounds, down slightly from 1987 (Table 1). Landings of the bottom fish management unit species (BMUS) averaged 5,500 pounds per trip in 1988, down 10% from 1987 (Table 1). The BMUS accounted for 80% of the landings by bottom fish vessels in the NWHI in 1988, compared with 84% in 1987 and 83% in 1986. On average, the vessels remaining in the fleet continued to concentrate on bottom fish and did not engage in alternative fisheries during the year.

BOTTOM FISH LANDINGS

Bottom fish landings in Hawaii are monitored in two ways: The State of Hawaii's Division of Aquatic Resources (HDAR) compiles reports of commercial fisheries landings, and the NMFS Fishery Management Research Program monitors sales of fish at a number of wholesale locations. Neither system accounts for fish caught by recreational or subsistence fishermen; both systems have significant limitations.

We believe the HDAR system undercounts landings because of underreporting. Also, these counts probably are biased because of differences in reporting levels by different segments of the fishery. The HDAR data were delayed for 1988 and therefore are not included in this report. The HDAR figures on bottom fish landings from 1970 through 1987 are presented in Table 2.

The NMFS monitoring system is limited by the extent of its sample of total landings. The sample changes slightly each year in terms of number of days monitored per year and the variables (e.g., species and locations) measured. The NMFS data are expanded to develop an estimate of total market quantities, which is based on our understanding of the proportion of the total market volume as represented by our monitoring sites. These market expansion factors are based on a 1979 survey of wholesale markets in Hawaii and on the landing patterns of specific fleets. The expansion factors range from 1 (indicating our sample represents the entire market for a particular gear and species combination) to 2 (indicating our sample is half the total market). The basis of this expansion should change as the market changes over time, but we do not have a reliable means for making such adjustments. Therefore, expansion factors have been static for the 5 years we have monitored the fishery.

We believe NMFS coverage of bottom fish landings from the NWHI is quite good, but we are more doubtful about its coverage of bottom fish landings from the MHI. Comparison of estimates from one year to the next must be used with care. Furthermore, examination of particular gear-species combinations suggests that, for the MHI bottom fish, the expansion factors may be too small. At the moment, there are no means to correct for this problem, but we are attempting to expand our sample size (both in terms of number and geographical range) and to field a new survey of wholesale dealers. The

Council's voluntary logbook program also has been amended to provide information on the disposition of catch, which may help resolve the problem. Our market monitoring program also collects price information. Average prices are adjusted during the market volume expansion procedure to account for differences in prices between sales locations.

Table 2.--Hawaii's commercial bottom fish landings, 1970-87, based on data from the Hawaii Division of Aquatic Resources.

Year	Landings (pounds)	Revenue (US$)	Price (US$) per pound*
1970	339,502	239,564	2.01
1971	406,006	310,021	2.09
1972	402,173	363,238	2.39
1973	446,139	413,523	2.34
1974	405,864	417,066	2.36
1975	555,255	591,645	2.24
1976	557,835	692,434	2.48
1977	560,447	762,327	2.58
1978	738,070	1,098,093	2.63
1979	692,430	1,120,363	2.57
1980	710,063	1,077,861	2.16
1981	637,841	1,253,469	2.53
1982	746,060	1,587,992	2.58
1983	880,169	1,956,060	2.62
1984	1,028,867	2,376,500	2.64
1985	1,079,619	2,646,412	2.65
1986	1,121,067	2,791,173	2.62
1987	1,087,912	3,103,576	2.95

*Prices were calculated from pounds sold, not landings (pounds caught); prices and revenues were adjusted for inflation to 1987 price levels.

Based on our estimates of Hawaii's bottom fish sales, landings from the NWHI declined significantly in 1988, but landings from the MHI substantially increased (Table 3; Fig. 2). Overall, bottom fish market prices in 1988 were stable (Fig. 3A). Prices for major species from the NWHI rose slightly in 1988 (Fig. 3B) while those from the MHI had a mixed record (Fig. 3C; Table 4). The overall economic value of Hawaii's bottom fish fishery has continued to grow in terms of total revenue generated in the market although the components of revenue have changed (Fig. 4).

Table 3.--Hawaii's market for bottom fish caught in the Northwestern Hawaiian Islands (NWHI) and main Hawaiian Islands (MHI), based on market expansion estimates by the National Marine Fisheries Service, 1984-88.

Source	1984	1985	1986	1987	1988
			Landings (in 1000s pounds)		
Hawaii	1,358	1,649	1,693	1,884	2,276
NWHI	661	922	869	1,015	625
MHI	697	727	824	869	1,651
Imports	152	264	319	472	334
Total bottom fish	1,510	1,913	2,012	2,356	2,610
			Revenue (in US $1000s)		
Hawaii	--	--	4,500	5,300	6,000
NWHI	--	--	1,900	2,300	1,500
MHI	--	--	2,600	3,000	4,500
Imports	--	--	760	1,140	790
Total bottom fish	--	--	5,260	6,440	6,790

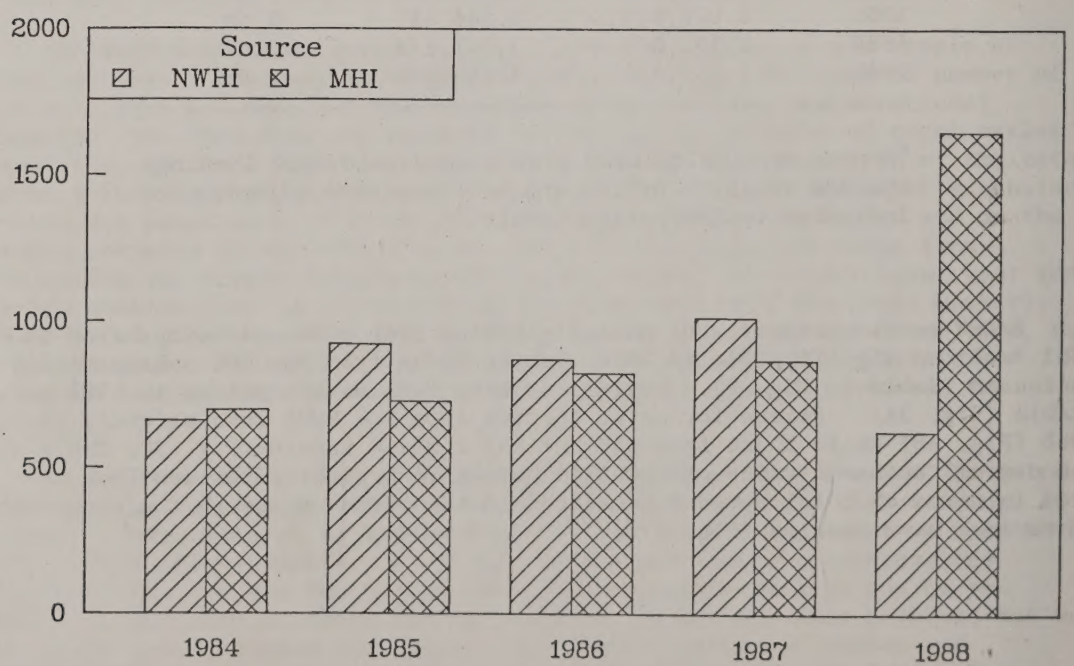
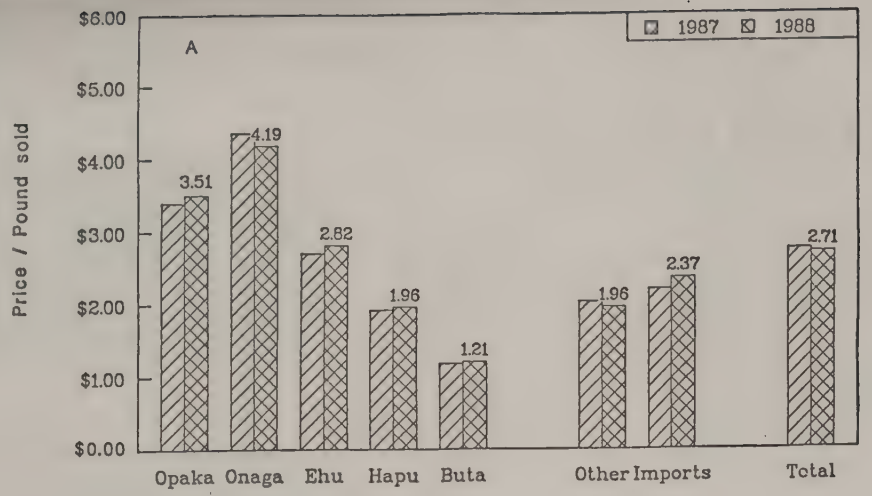


Figure 2.--Hawaii's bottom fish landings, 1984-88, based on estimates made by the National Marine Fisheries Service (NWHI = Northwestern Hawaiian Islands).



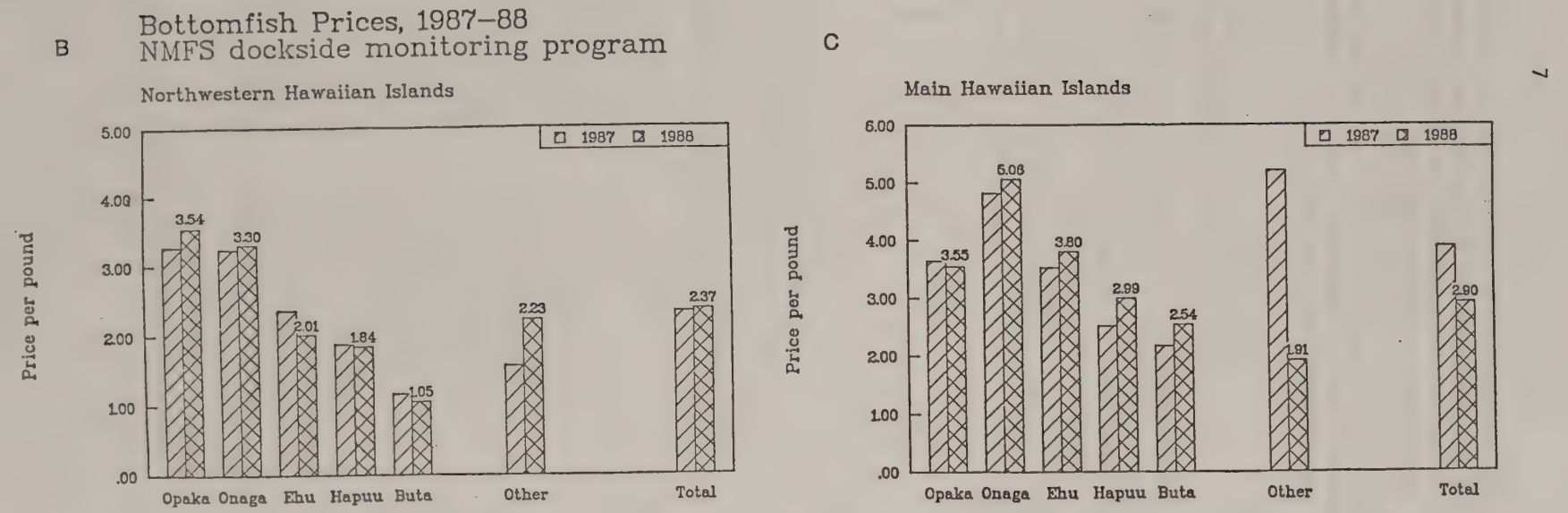


Figure 3.--Hawaii's market prices for bottom fish, 1987-88 (NWHI = Northwestern Hawaiian Islands; MHI = main Hawaiian Islands). (A) NWHI and MHI combined, (B) NWHI, and (C) MHI.

Table 4.--Hawaii's bottom fish prices by capture location, and Hawaii's bottom fish market prices by species and source, 1987-88 (NWHI = Northwestern Hawaiian Islands; MHI = main Hawaiian Islands).

Species	1987 price (US$)/pound			1988 price (US$)/pound		
	Market	NWHI	MHI	Market	NWHI	MHI
Opakapaka	3.40	3.27	3.64	3.51	3.54	3.55
Onaga	4.36	3.23	4.81	4.19	3.30	5.06
Ehu	2.71	2.36	3.52	2.82	2.01	3.80
Hapuupuu	1.92	1.87	2.51	1.96	1.84	2.99
Butaguchi (ulua)	1.18	1.16	2.17	1.21	1.05	2.54
Other bottom fish	2.03	1.56	5.20	1.96	2.23	1.91
Imports	2.21			2.37		
Total	2.75	2.33	3.87	2.71	2.37	2.90

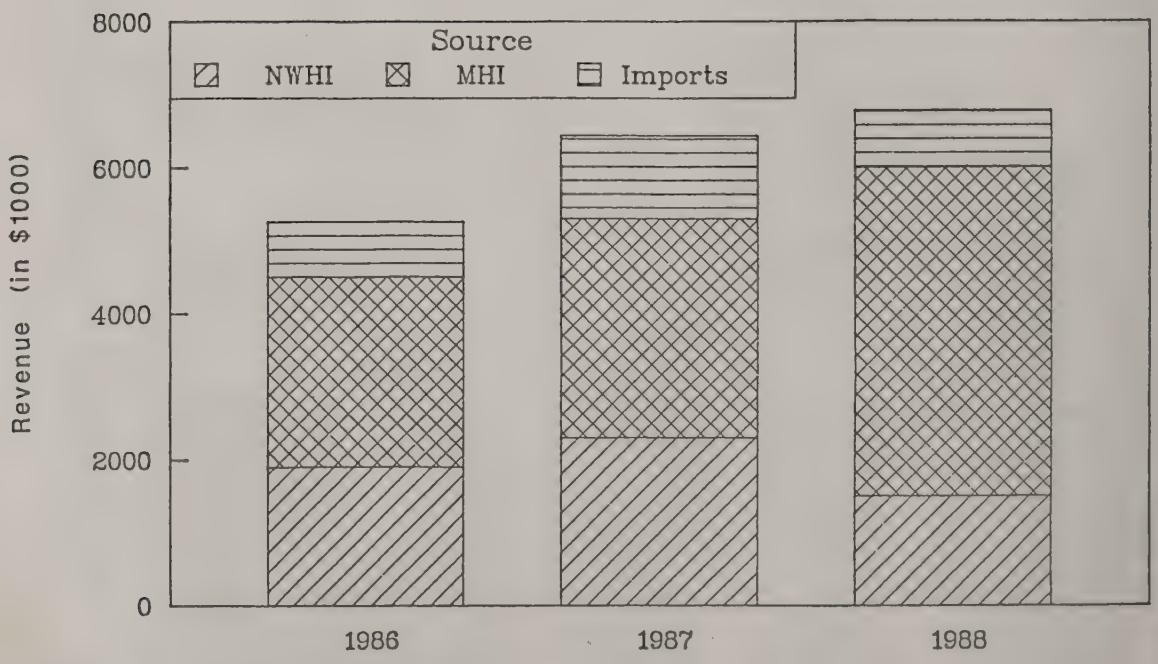


Figure 4.--Hawaii's bottom fish market revenue, 1984-88 (NWHI = Northwestern Hawaiian Islands; MHI = main Hawaiian Islands).

The top five bottom fish species accounted for 88% of the BMUS landings by NWHI vessels in 1988 (Table 5; Fig. 5). For the first time, opakapaka did not dominate landings, amounting to only 25% of the weight landed in 1988 compared with 37% in 1987. Hapuupuu also supplied 25% of the landings. Butaguchi (a jack) constituted 18% of the landings, and onaga (a red snapper), 13%. In terms of revenue, figures are quite different because of the higher prices for opakapaka and onaga compared with hapuupuu and butaguchi. Species composition is not given for the MHI because of potential biases in our samples.

BOTTOM FISH IMPORTS TO HAWAII

Import data for Hawaii were obtained from the U.S. Food and Drug Administration (FDA) and compiled by the Southwest Region, NMFS. Imports of bottom fish to Hawaii, largely from Pacific island countries such as Fiji, declined in 1988 to 334,000 pounds (Fig. 6). Almost all of the imports are snappers. For a number of years, both American Samoa and Guam sent a substantial bottom fish catch to Hawaii, but in recent years, the quantities of individual lots have not been sufficient for tracking by the data system of the FDA.

Table 5.--Species composition of bottom fish landings in the Northwestern Hawaiian Islands, 1986-88 (BMUS = bottom fish management unit species).

	Catch (in 1000s pounds)		
Species	1986	1987	1988
Opakapaka	297	370	154
Onaga	106	77	80
Ehu	30	40	45
Hapuupuu	210	223	156
Butaguchi (ulua)	160	217	111
Other BMUS	32	74	75
Total BMUS	835	1,001	621
Other bottom fish	35	14	5
Total bottom fish	870	1015	626

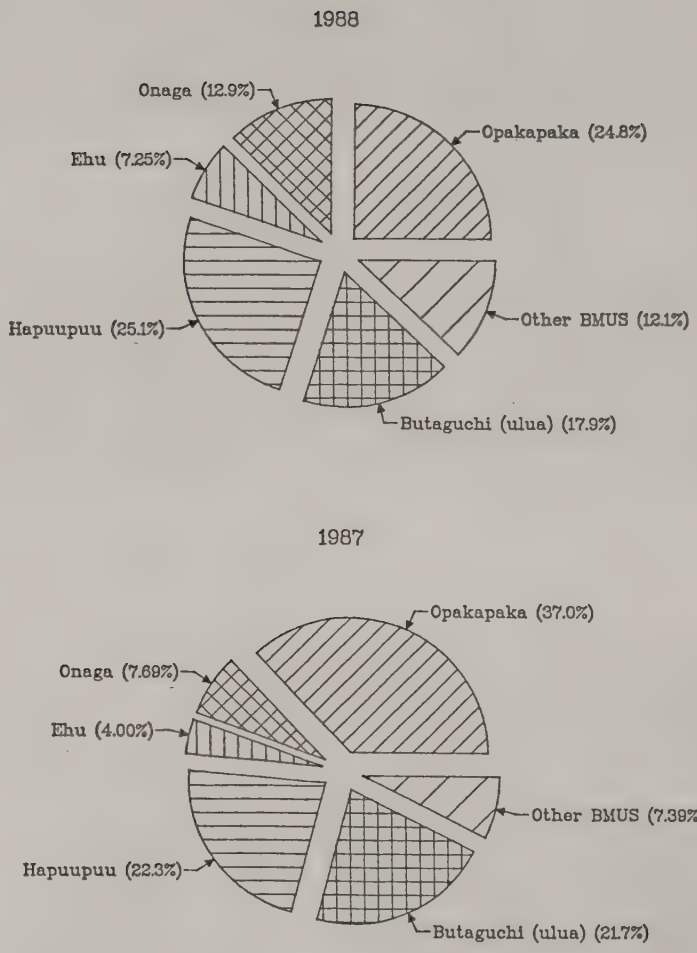


Figure 5.--Species composition of landings (by weight) by the bottom fish fleet in the Northwestern Hawaiian Islands, 1987-88.

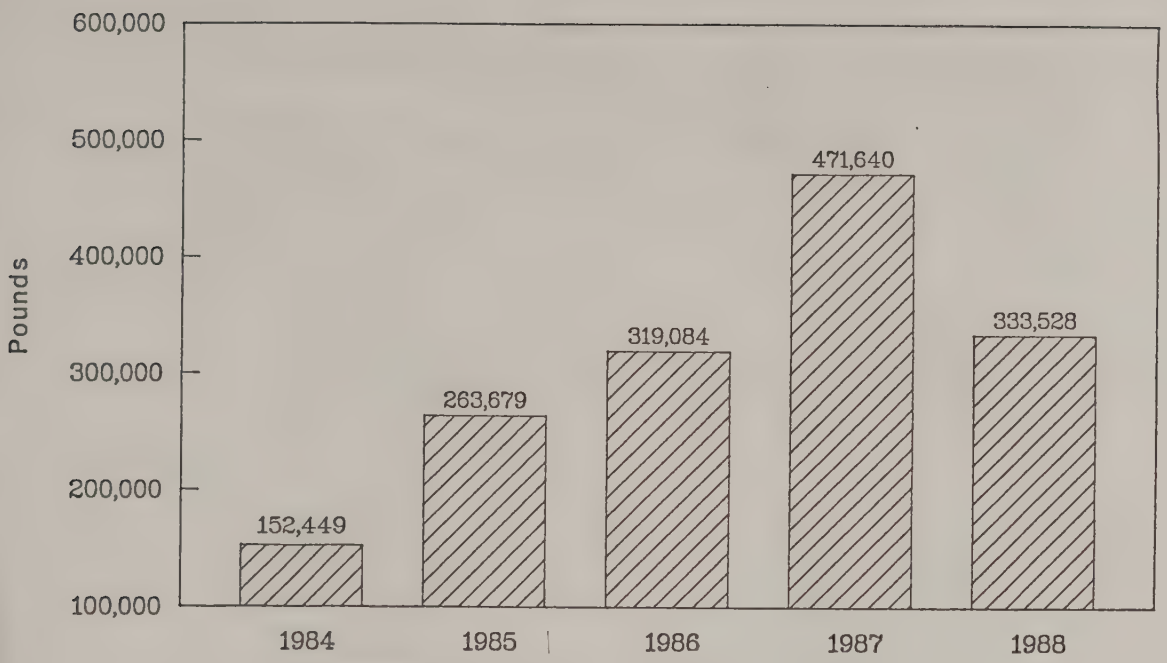


Figure 6.--Bottom fish imports to Hawaii, 1984-88.

ECONOMIC AND FLEET RESEARCH

Our major economic research project in 1988 was an attempt to describe the economics of vessel operations in the NWHI bottom fish fishery. Data were obtained on the operational costs for each of the major types of bottom fish vessels, then integrated with operational data for 1987. At present, the 1988 operational data are being integrated with these cost data to provide an overall profile of vessel economics.

No clear categories of vessels by cost or revenue were apparent from these data, although clear physical distinctions exist among motor-sailers; larger, multipurpose fishing vessels; and smaller, bottom fishing boats. Using average figures for 1987 costs (adjusted for inflation to 1988 price levels), ignoring the differences between types of boats, and using fleet-average performance figures for 1988 indicate the average NWHI bottom fishing vessel made a slight profit (net revenue) of $6,300 (Table 6). It is important to realize that this result is "hypothetical" in the sense that it uses average operating patterns for the fleet as a whole. Some full-time vessels may have done much better, some part-time vessels may have successfully covered their costs during their period in the fishery, and a number of vessels probably had considerable losses. This analysis also suggests the average vessel operated 44% of the time in the NWHI bottom fish fishery, the remaining time being spent in other fisheries or inactive. A full-time, "annualized" performance in 1988 would have generated $16,600 in net revenue, perhaps more indicative of economic returns to the active vessels (Table 7). However, even this figure represents a return on investment of less than 6%.

Table 6.-Economic performance of bottom fish vessels (N = 7) fishing in the Northwestern Hawaiian Islands, 1988, based on preliminary data.

Income statement: Fleet average	Subtotal	Total
Revenue (US$)		115,890
Fixed costs (US$)		21,467
Capital	5,152	
Annual repair	6,572	
Vessel insurance	6,323	
Administrative	708	
Other	2,712	
Operating costs (US$)		88,123
Fuel and oil	12,817	
Ice	2,533	
Bait	4,458	
Handling	11,120	
Provisions	5,066	
Maintenance	12,160	
Supplies	3,314	
Gear	755	
Other	200	
Labor income	31,734	
Captain's bonus	3,967	
Total cost (US$)		109,591
Net revenue (US$)		6,299
Operating characteristics		
Investment (US$)	285,381	
Trips (No.)	7.15	
Catch per day (pounds)	977	
Trip days	15.25	
Fishing days	7.00	
Crew share %	50.0	
Crew (No.)	4.00	
Shared costs (US$)	52,423	
Product price per pound (US$)	2.37	
Total catch (US$)	48,899	
Capital factor (%)	3.4	
Depreciation factor (%)	4.0	
Fixed costs share (%)	43.6	

Table 7.--Annualized Northwestern Hawaiian Islands bottom fish vessel full-time operations.

Income statement: Fleet average	Subtotal	Total
Revenue (US$)		265,759
Fixed costs (US$)		47,117
Capital	9,703	
Annual repair	15,071	
Vessel insurance	14,500	
Administrative	1,623	
Other	6,219	
Operating costs (US$)		202,084
Fuel and oil	29,392	
Ice	5,808	
Bait	10,223	
Handling	25,500	
Provisions	11,617	
Maintenance	27,885	
Supplies	7,601	
Gear	1,732	
Other	458	
Labor income	72,771	
Captain's bonus	9,096	
Total cost (US$)		249,201
Net revenue (US$)		16,558
Operating characteristics		
Investment (US$)	85,381	
Trips (No.)	16.40	
Catch per day (pounds)	977	
Trip days	15.25	
Fishing days	7.00	
Crew share (%)	50.0	
Crew (No.)	4.00	
Shared costs (US$)	120,216	
Product price per pound (US$)	2.37	
Total catch (US$)	112,135	
Capital factor (%)	3.4	
Depreciation factor (%)	4.0	
Fixed costs share (%)	100.0	

We have also replicated earlier market research (Pooley 1987) on the responsiveness of bottom fish prices in Hawaii's market. Based on this research, bottom fish prices continue to be relatively flexible in response to changes in quantities in the marketplace (Fig. 7). The weekly volume of bottom fish sales and average prices for 1988 are shown in Figure 8. The quantities and prices are based on our estimates of total market volume, including imports and sales throughout Hawaii. The price premium for bottom fish landed from the MHI continued to hold. The highest demand is for MHI bottom fish landed during the holiday season (Thanksgiving through New Year's Day), whereas the lowest demand is for NWHI bottom fish landed during the off-season (February-October) (Fig. 7). The reason for the differences in price by area is the fish from the MHI are fresher. Using opakapaka as an example, the difference in price ranges from $0.69 per pound above the average price for on-season MHI bottom fish to $0.44 per pound below the average price for off-season NWHI bottom fish, based on linear regression analysis.

The precision biological assessment (Ralston and Kawamoto 1988) indicated that several bottom fish species in the MHI were stressed by the level of effort in the fishery. Therefore, proposals were made by some people in the fishery and by the HDAR that a new minimum size be implemented for some species. The HDAR plans to change existing minimum sizes through its administrative rules and public hearing process in 1989. We investigated briefly the price differences by size of four major commercial bottom fish species (Fig. 9). Interpreting the data is difficult because of the many influences on average price per pound. Generally speaking, a higher price per pound exists for smaller fish. Small fish often have a 100% yield (to the wholesaler) since they are sold whole and frequently cooked and consumed whole. Since yield for large fish is greater than for medium-sized fish, large fish sometimes have a higher price than the average.

Another area of economic research included a computer model of the NWHI bottom fish fishery that was completed this year (Kasaoka 1989a). The model is a mathematical representation of fishing activity and revenue and uses an economic technique called linear programming. In brief, the model estimates net revenue (profit) for (1) each of four fishing vessel types (large- and medium-sized multipurpose vessels, tuna longliners, and motor-sailers), (2) in each of four fishing areas (upper and lower sections of the NWHI Ho'omalu Zone, the NWHI Mau Zone, and the MHI), (3) in three seasons, and (4) for three target species groups (high- and low-priced bottom fish, and pelagic fishes). The model includes vessels, such as longliners, that fish only occasionally in the NWHI bottom fish fishery and target species, such as pelagic fishes, that are not found in the NWHI bottom fish fishery but are sought on occasion by bottom fish vessels. The model is constrained by the number of vessels allocated to each fleet and by the availability of each species group. The model then allocates fishing time for each of the four fleet segments based on optimal profit per area, species, and season. This model will be further developed as we begin to have experience with the impact of the limited entry program in the NWHI. Although further data refinement and testing are required before this model can be used for policy purposes, it represents a major step in attempting to understand the relationship between regulation and fishing.

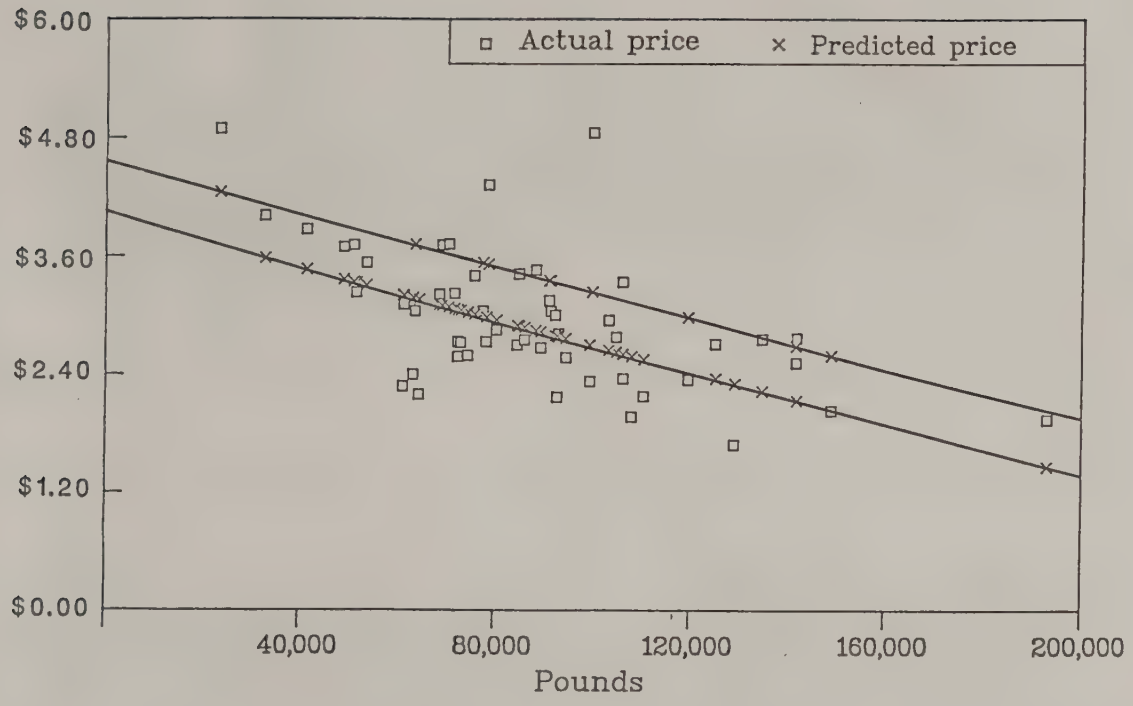


Figure 7.--Demand relationship (average price and quantity sold) for Hawaii's bottom fish, 1988. (The upper predicted price line represents on-season demand; the lower line represents off-season demand.)

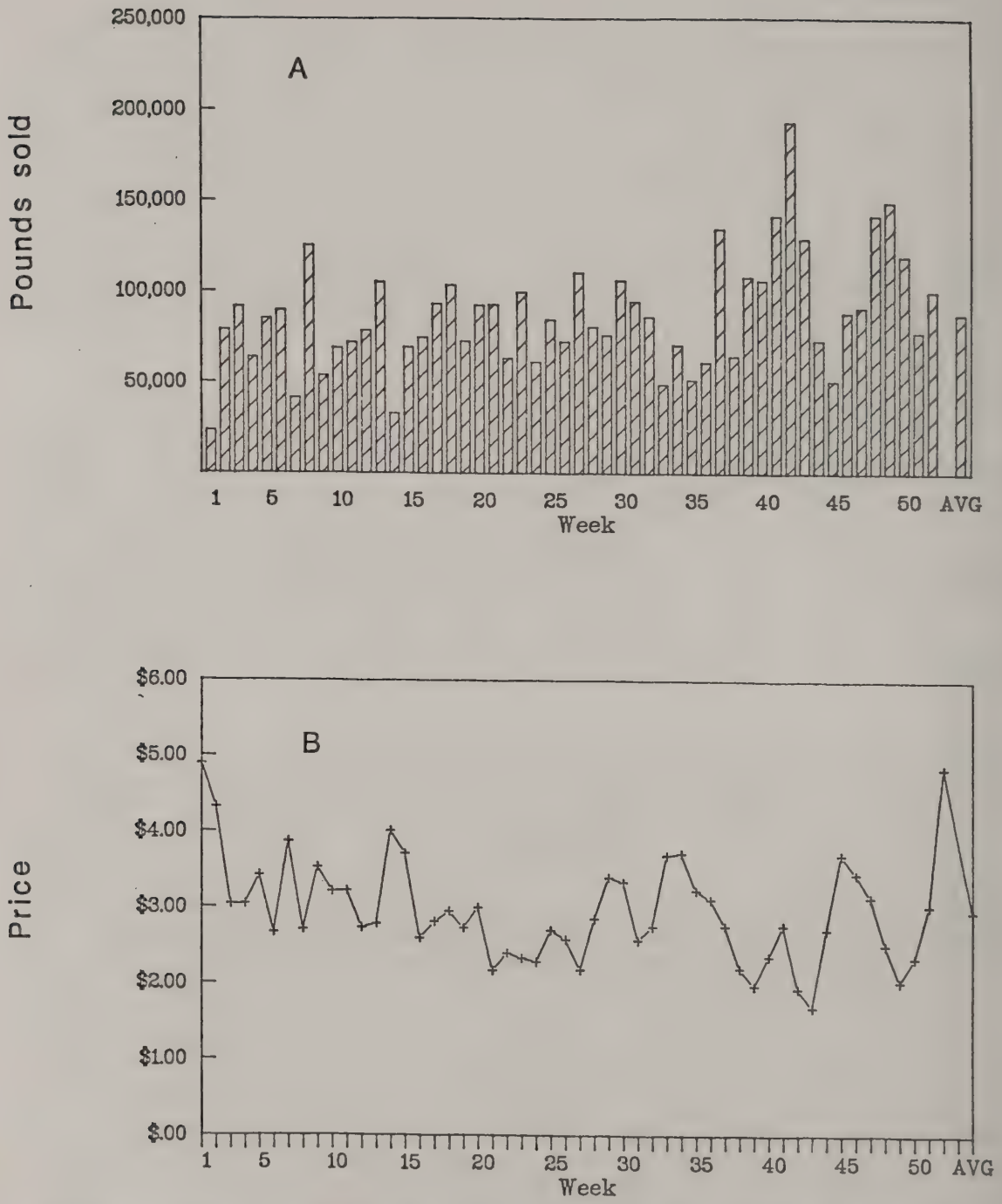


Figure 8.--Weekly (A) market sales (in pounds) and (B) average prices ($US) per pound for Hawaii's bottom fish, 1988.

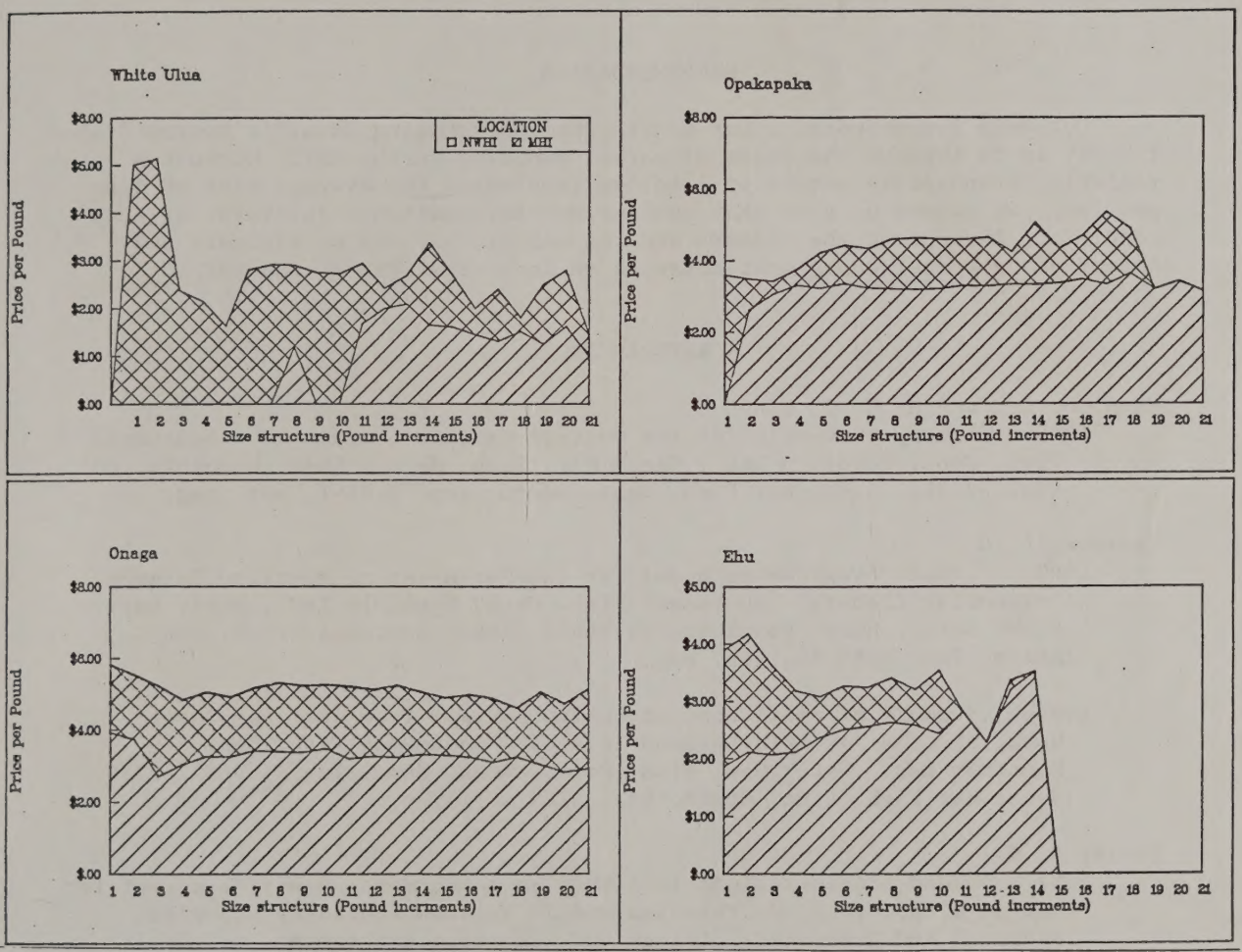


Figure 9.--Unweighted average prices per pound by size for four major bottom fish species, 1987.

Finally, in a cooperative research project oriented toward American Samoa, Guam, and Commonwealth of the Northern Mariana Islands, the costs, revenues, and operational characteristics of small fishing boats were estimated based on surveys coordinated by the Council and experts in each area (Kasaoka 1989b). These data will be compiled into an economic analysis of small boat operations for these three areas; however, only a portion of these vessels' catches is from bottom fish.

RECOMMENDATION

Our only recommendation for monitoring and managing Hawaii's bottom fish fishery is to improve the scope of market sampling in the MHI. Without a reliable, broad-scale sample of landings (including the average size of fish per lot), we cannot be sure that our current information accurately reflects conditions throughout the fishery and the market, nor can we estimate the impact of potential management measures on locations through the MHI.

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